[54] **SYSTEM FOR TERMINATING MULTICAST CHANNEL AND DATA BROADCAST WHEN AT LEAST TWO SECOND ENDPOINTS DO NOT TRANSMIT POSITIVE ACKNOWLEDGMENT MESSAGE TO FIRST ENDPONT**

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Related U.S. Application Data

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[58] Field of Search 395/200.57, 200.34, 395/200.58, 200.61, 200.67; 709/227, 204, 231, 237, 228; 399/202

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,507,781	3/1985	Alvarez, III et al.	370/95.3
4,756,019	7/1988	Szybicki	379/112
4,760,572	7/1988	Tomikawa	370/390
4,893,326	1/1990	Duran et al.	379/53
5,077,732	12/1991	Fischer et al.	370/437
5,099,510	3/1992	Blinken, Jr. et al.	379/202
5,101,451	3/1992	Ash et al.	379/221

FOREIGN PATENT DOCUMENTS

2080530	4/1994	Canada .
0279232	8/1988	European Pat. Off. .

OTHER PUBLICATIONS

PCT International Search Report (PCT/US96/02459) mailed Aug. 7, 1996.

Mon–Song Chen, et al., "Designing a Distributed Collaborative Environment," *Communication for Global Users, including a Communications Theory Mini Conference*, Orlando, Dec. 6–9, 1992, Insitute of Electrical and Electronics Engineers, pp. 219–219.

W.H. Leung, et al., "Multimedia Conferencing Capabilities in an Experimental Fast Packet Network," *Proceedings of the International Switching Symposium*, Yokohama, Oct. 25, 1992, Institute of Electronics, Information and Communication Engineers, pp. 258–262.

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[57] **ABSTRACT**

A method and apparatus for optimizing transmission of data to a plurality of second endpoints in a system wherein a first endpoint is providing data to the plurality of second endpoints each connected by a point-to-point communication channels. This may be useful in teleconferencing applications with a plurality of participants (endpoints) or broadcast server applications. The first endpoint activates a multicast communication channel having a first multicast address and commences broadcast of the data over the multicast communication channel. The first endpoint transmits a request message to each of the plurality of second endpoints in order to query each of the second endpoints whether they can receive transmissions broadcast to the first multicast address. Certain of the plurality of second endpoints transmit an acknowledgment message if they can receive transmissions broadcast to the first multicast address, and the first endpoint receives the acknowledgment message. Then, for each acknowledgment message received from certain of the plurality of second endpoints, the first endpoint deactivates the point-to-point communication channel and the certain of the plurality of second endpoints.

15 Claims, 27 Drawing Sheets
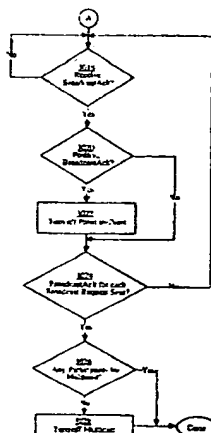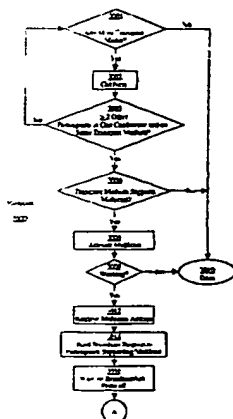
U.S. PATENT DOCUMENTS

5,136,581	8/1992	Muehrcke	370/62
5,157,662	10/1992	Tadamura et al.	370/352
5,195,086	3/1993	Baumgartner et al.	370/62
5,200,951	4/1993	Grau et al.	370/62
5,241,625	8/1993	Epard et al.	395/163
5,276,679	1/1994	McKay et al.	370/358
5,291,492	3/1994	Andrews et al.	370/110.1
5,297,143	3/1994	Fridrich et al.	370/85.3
5,309,433	5/1994	Cidon et al.	370/60
5,311,585	5/1994	Armstrong et al.	379/221
5,315,586	5/1994	Charvillat	370/60
5,323,445	6/1994	Nakatsuka	348/15
5,341,374	8/1994	Lewen et al.	370/85.4
5,355,371	10/1994	Auerbach et al.	370/60
5,371,534	12/1994	Dagdeviren et al.	348/14
5,373,549	12/1994	Bales et al.	379/93
5,374,952	12/1994	Flohr	348/12
5,375,068	12/1994	Palmer et al.	364/514
5,392,344	2/1995	Ash et al.	379/221
5,422,883	6/1995	Hauris et al.	370/62
5,422,942	6/1995	Kakwashima	379/212
5,440,624	8/1995	Schoof, II	379/202
5,442,749	8/1995	Northcutt et al.	395/200.09
5,453,780	9/1995	Chen et al.	348/15
5,455,826	10/1995	Özveren et al.	370/232
5,459,725	10/1995	Bodner et al.	370/60
5,473,679	12/1995	La Porta et al.	379/201
5,475,746	12/1995	Miller et al	379/201
5,483,587	1/1996	Hogan et al.	379/202
5,483,588	1/1996	Eaton et al.	379/202
5,491,798	2/1996	Bonsall et al.	395/200.04
5,509,010	4/1996	La Porta et al.	370/397
5,511,168	4/1996	Perlman et al.	395/200.15
5,541,927	7/1996	Kristol et al.	370/94.2
5,557,724	9/1996	Sampat et al.	395/157
5,572,582	11/1996	Riddle	379/202

OTHER PUBLICATIONS

C. Kim et al., "Performance of Call Splitting Algorithms for Multicast Traffic," INFOCOM '90, pp. 348–356 (1990).

J. Ott et al., "Multicasting the ITU MCS: Integrating Point-to-Point abd Multicast Transport" Singapore *ICCS*, pp. 1013–1017 (1994).

R. bubenik et al., "Multipoint Connection Management in High Speed Networks," INFOCOM '91, pp. 59–67 (1991).

"Dynamic Conference Call Participation" IBM Technical Disclosure Bulletin, V. 28, Aug. 1995, pp. 1135–1138.

"Control of Video Telephony from a Data Conferencing System", IBM Technical Disclosure Bulletin, v. 37, Oct. 1994, pp. 327–332.

"Intelligent Packet Relay in Distributed Multimedia Systems", IBM Technical Disclosure Bulletin, v. 37, Jul. 1994, pp. 211–214.